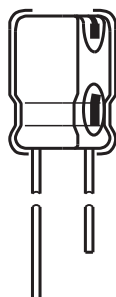


Aluminum Electrolytic Capacitors



FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Radial leads, cylindrical aluminum case
- High CV per unit volume, low ESR
- Ø 5 mm to Ø 18 mm, 105 °C, up to 10 000 h endurance
- Material categorization: for definitions of compliance please see www.vishay.com/doc?999912


RoHS
COMPLIANT

APPLICATIONS

- Decoupling, smoothing, filtering, buffering in SMPS
- General industrial, telecom, and domestic appliances
- Portable and mobile equipment (small size, low mass)

QUICK REFERENCE DATA

DESCRIPTION	UNIT	VALUE
Nominal case sizes (Ø D x L)	mm	5 x 11 to 18 x 40
Rated capacitance range	µF	2.2 to 18 000
Capacitance tolerance	%	± 20 (at 120 Hz, 20 °C)
Rated voltage range	V _{DC}	6.3 to 63
Category temperature range	°C	-55 to +105
Endurance	h	Up to 10 000
Shelf life	h	1000

ORDERING INFORMATION

Part number example: ZRC00FE1021VTFL

ZRC	00	FE	102	1V	TF	L
SERIES NAME	DESIGN/FORMING	DIMENSIONS	CAPACITANCE	VOLTAGE	PACKING	INTERNAL CODE
		See "Dimensions" table	See "Selection Chart"	See "Selection Chart"	00 = bulk TF = ammopack, formed lead ⁽¹⁾ TN = ammopack, straight lead ⁽¹⁾	

Note

⁽¹⁾ See "Taping Specifications"

**ADDITIONAL ELECTRICAL DATA**

LEAKAGE CURRENT (Test conditions: U_R , 20 °C)			
RATED VOLTAGE	TIME	CASE SIZE	VALUE
6.3 V to 63 V	After 2 min	Ø 5 mm to Ø 18 mm	$I = 0.01 CV$ or 3 μA , whichever is greater (after 2 min)

Notes

- Where, C = rated capacitance in μF
- V = rated DC working voltage in V

DISSIPATION FACTOR ($\tan \delta$ at 120 Hz, 20 °C)							
RATED VOLTAGE	6.3	10	16	25	35	50	63
$\tan \delta$ max.	0.22	0.19	0.16	0.14	0.12	0.10	0.09

Note

- When the capacitance exceeds 1000 μF , 0.02 shall be added every 1000 μF increase.

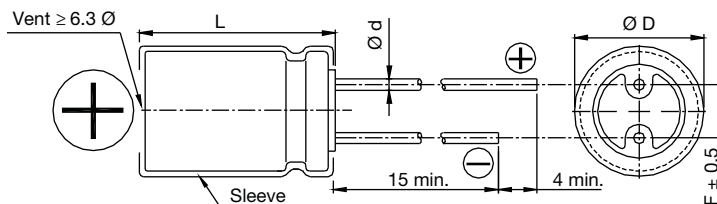
LOW TEMPERATURE BEHAVIOR (at 120 Hz)								
IMPEDANCE RATIO	CASE SIZE	RATED VOLTAGE						
		6.3	10	16	25	35	50	63
$\frac{Z_{(-55\text{ °C})}}{Z_{(+20\text{ °C})}}$	Ø 5 mm to Ø 18 mm	3	3	3	3	3	3	3

MULTIPLIER OF RIPPLE CURRENT AS A FUNCTION OF FREQUENCY					
FREQUENCY (Hz)	CAPACITANCE (μF)				
	< 33	39 to 270	330 to 680	820 to 1800	2200 to 18 000
120	0.42	0.50	0.55	0.60	0.70
1000	0.70	0.73	0.77	0.80	0.85
10 000	0.90	0.92	0.94	0.96	0.98
100 000 and up	1.00	1.00	1.00	1.00	1.00

TEST PROCEDURES AND REQUIREMENTS						
TEST	TEST TIME	Ø D (mm)	RATED VOLTAGE (V)	CAPACITANCE CHANGE	DISSIPATION FACTOR	LEAKAGE CURRENT
Endurance ⁽¹⁾	4000 h	5 to 6.3	6.3 to 10	Within ± 25 % of initial value	Less than 200 % of specified value	Within specified value
	6000 h	8 to 10				
	8000 h	≥ 12.5				
	5000 h	5 to 6.3	16 to 63			
	7000 h	8 to 10				
	10 000 h	≥ 12.5				
Shelf life ⁽²⁾	1000 h	5 to 18	6.3 to 63			

Notes

- ⁽¹⁾ The above specifications shall be satisfied when the capacitors are restored to 20 °C after the rated voltage applied with rated ripple current for 4000 h to 10 000 hours at 105 °C.
- ⁽²⁾ The above specifications shall be satisfied when the capacitors are restored to 20 °C after exposing them for 1000 h at 105 °C without voltage applied.

DIMENSIONS in millimeters


CASE SIZE CODE		$\varnothing D \pm 0.5$	L	$\varnothing d$	$F \pm 0.5$
AA	5 x 11	5	11 ± 1.0	0.5	2.0
BA	6.3 x 11	6.3	11 ± 1.0	0.5	2.5
PB	8 x 11.5	8	11.5 ± 1.0	0.6	3.5
PD	8 x 15	8	15 ± 1.0	0.6	3.5
PE	8 x 20	8	20 ± 1.0	0.6	3.5
DC	10 x 12.5	10	12.5 ± 1.5	0.6	5.0
DD	10 x 16	10	16 ± 1.5	0.6	5.0
DE	10 x 20	10	20 ± 1.5	0.6	5.0
DG	10 x 25	10	25 ± 1.5	0.6	5.0
DJ	10 x 30	10	30 ± 1.5	0.6	5.0
FD	12.5 x 16	12.5	16 ± 1.5	0.6	5.0
FE	12.5 x 20	12.5	20 ± 1.5	0.6	5.0
FG	12.5 x 25	12.5	25 ± 1.5	0.6	5.0
FJ	12.5 x 30	12.5	30 ± 1.5	0.6	5.0
FU	12.5 x 35	12.5	35 ± 1.5	0.6	5.0
FK	12.5 x 40	12.5	40 ± 1.5	0.6	5.0
JD	16 x 16	16	16 ± 1.5	0.8	7.5
JE	16 x 20	16	20 ± 1.5	0.8	7.5
JG	16 x 25	16	25 ± 1.5	0.8	7.5
JS	16 x 31.5	16	31.5 ± 1.5	0.8	7.5
JL	16 x 35.5	16	35.5 ± 1.5	0.8	7.5
JK	16 x 40	16	40 ± 1.5	0.8	7.5
KD	18 x 16	18	16 ± 1.5	0.8	7.5
KE	18 x 20	18	20 ± 1.5	0.8	7.5
KG	18 x 25	18	25 ± 1.5	0.8	7.5
KS	18 x 31.5	18	31.5 ± 1.5	0.8	7.5
KL	18 x 35.5	18	35.5 ± 1.5	0.8	7.5
KK	18 x 40	18	40 ± 1.5	0.8	7.5

Note

- Please see "Taping Specifications" for details on taped products

**SELECTION CHART, DIMENSIONS, AND PERMISSIBLE RIPPLE CURRENT**

V _{DC}		6.3 (0J)				10 (1A)				16 (1C)				25 (1E)			
CAP.	CODE	Ø D x L	IMP. MAX./ 100 kHz		RIPPLE CURRENT (105 °C)	Ø D x L	IMP. MAX./ 100 kHz		RIPPLE CURRENT (105 °C)	Ø D x L	IMP. MAX./ 100 kHz		RIPPLE CURRENT (105 °C)	Ø D x L	IMP. MAX./ 100 kHz		RIPPLE CURRENT (105 °C)
			20 °C	-10 °C			100 kHz	20 °C			-10 °C	100 kHz			20 °C	-10 °C	
			Ω	mA	Ω		mA	Ω	mA		Ω	mA	Ω		mA		
47	470												5 x 11	0.58	1.16	210	
56	560								5 x 11	0.58	1.16	210					
100	101					5 x 11	0.58	1.16	210				6.3 x 11	0.22	0.44	340	
120	121									6.3 x 11	0.22	0.44	340				
150	151	5 x 11	0.58	1.16	210												
220	221					6.3 x 11	0.22	0.44	340	8 x 11.5	0.11	0.22	640	8 x 11.5	0.11	0.22	640
330	331	6.3 x 11	0.22	0.44	340					8 x 11.5	0.11	0.22	640	8 x 15 10 x 12.5	0.083 0.080	0.166 0.160	840 865
470	471					8 x 11.5	0.11	0.22	640	8 x 15 10 x 12.5	0.083 0.080	0.166 0.160	840 865	8 x 20 10 x 16	0.064 0.060	0.128 0.120	1050 1210
680	681	8 x 11.5	0.11	0.22	640	8 x 15 10 x 12.5	0.083 0.080	0.166 0.160	840 865	8 x 20 10 x 16	0.064 0.060	0.128 0.120	1050 1210	10 x 20 12.5 x 16	0.046 0.049	0.092 0.098	1400 1450
820	821	10 x 12.5	0.08	0.16	865									10 x 25	0.042	0.084	1650
1000	102	8 x 15	0.087	0.174	840	8 x 20 10 x 16	0.064 0.060	0.128 0.120	1050 1210	10 x 20 12.5 x 16	0.046 0.049	0.092 0.098	1400 1450	10 x 30 12.5 x 20 16 x 16	0.031 0.035 0.042	0.062 0.070 0.084	1910 1900 1940
1200	122	8 x 20 10 x 16	0.069 0.060	0.128 0.120	1050 1210	10 x 20	0.046	0.092	1400	10 x 25	0.042	0.084	1650	18 x 16	0.043	0.086	2210
1500	152	10 x 20	0.046	0.092	1400	10 x 25 12.5 x 16	0.042 0.049	0.084 0.090	1650 1450	10 x 30 12.5 x 20 16 x 16	0.031 0.035 0.042	0.062 0.070 0.084	1910 1900 1940	12.5 x 25	0.027	0.054	2230
1800	182	12.5 x 16	0.045	0.090	1450									12.5 x 30 16 x 20	0.024 0.027	0.048 0.054	2650 2530
2200	222	10 x 25	0.042	0.084	1650	10 x 30 12.5 x 20 16 x 16	0.031 0.035 0.042	0.062 0.070 0.084	1910 1900 1940	12.5 x 25 18 x 16	0.027 0.043	0.054 0.086	2230 2210	12.5 x 35 18 x 20	0.020 0.026	0.040 0.052	2880 2860
2700	272	10 x 30 16 x 16	0.031 0.042	0.062 0.084	1910 1940	18 x 16	0.043	0.086	2210	12.5 x 30 16 x 20	0.024 0.027	0.048 0.054	2650 2530	12.5 x 40 16 x 25	0.017 0.021	0.034 0.042	3350 2930
3300	332	12.5 x 20	0.035	0.070	1900	12.5 x 25	0.027	0.054	2230	12.5 x 35	0.020	0.040	2880	16 x 31.5 18 x 25	0.017 0.019	0.034 0.038	3450 3140
3900	392	12.5 x 25 18 x 16	0.027 0.043	0.054 0.086	2230 2210	12.5 x 30 16 x 20	0.024 0.027	0.048 0.054	2650 2530	12.5 x 40 16 x 25 18 x 20	0.017 0.021 0.026	0.034 0.042 0.052	3350 2930 2860	16 x 35.5 18 x 31.5	0.015 0.015	0.030 0.030	3610 4170
4700	472	12.5 x 30	0.024	0.048	2650	12.5 x 35	0.020	0.040	2880	16 x 31.5 18 x 25	0.017 0.019	0.034 0.038	3450 3140	16 x 40 18 x 35.5	0.013 0.014	0.026 0.028	4080 4220
5600	562	12.5 x 35 16 x 20	0.020 0.027	0.040 0.054	2880 2530	12.5 x 40 16 x 25 18 x 20	0.017 0.021 0.026	0.034 0.042 0.052	3350 2930 2860	16 x 35.5 18 x 31.5	0.015 0.015	0.030 0.030	3610 4170	18 x 40	0.012	0.024	4280
6800	682	12.5 x 40 16 x 25 18 x 20	0.017 0.021 0.026	0.034 0.042 0.052	3350 2930 2860	16 x 31.5 18 x 25	0.017 0.019	0.034 0.038	3450 3140	16 x 40	0.013	0.026	4080				
8200	822	16 x 31.5	0.017	0.034	3450	16 x 35.5 18 x 31.5	0.015 0.015	0.030 0.030	3610 4170	18 x 35.5	0.014	0.020	4220				
10 000	103	16 x 35.5 18 x 25	0.015 0.019	0.030 0.038	3610 3140	16 x 40 18 x 35.5	0.013 0.014	0.026 0.028	4080 4220	18 x 40	0.012	0.024	4280				
12 000	123	16 x 40 18 x 31.5	0.013 0.015	0.026 0.030	4080 4170	18 x 40	0.012	0.024	4280								
15 000	153	18 x 35.5	0.014	0.028	4220												
18 000	183	18 x 40	0.012	0.024	4280												

**SELECTION CHART, DIMENSIONS, AND PERMISSIBLE RIPPLE CURRENT**

V _{DC}		35 (1V)				50 (1H)				63 (1J)			
CAP.	CODE	Ø D x L	IMPEDANCE MAX./100 kHz		RIPPLE CURRENT (105 °C)	Ø D x L	IMPEDANCE MAX./100 kHz		RIPPLE CURRENT (105 °C)	Ø D x L	IMPEDANCE MAX./100 kHz		RIPPLE CURRENT (105 °C)
			20 °C	-10 °C			20 °C	-10 °C			20 °C	-10 °C	
			Ω		100 kHz		Ω		100 kHz		Ω		100 kHz
					mA				mA				mA
3.3	3R3					5 x 11	2.9	5.8	53				
4.7	4R7					5 x 11	2.5	5.0	95				
10	100					5 x 11	2.0	4.0	130				
15	150									5 x 11	1.2	2.4	165
22	220					5 x 11	0.91	1.82	180				
33	330	5 x 11	0.58	1.16	210					6.3 x 11	0.49	0.98	265
56	560	6.3 x 11	0.22	0.44	340	6.3 x 11	0.39	0.78	295	8 x 11.5	0.31	0.62	500
82	820									8 x 15 10 x 12.5	0.22 0.15	0.44 0.30	665 690
100	101					8 x 11.5	0.22	0.44	555				
120	121					8 x 15	0.150	0.30	730	8 x 20 10 x 16	0.17 0.11	0.34 0.22	820 950
150	151	8 x 11.5	0.11	0.22	640	10 x 12.5	0.160	0.32	760				
180	181					8 x 20	0.118	0.236	910	10 x 20 12.5 x 16	0.078 0.101	0.156 0.202	1150 1150
220	221	8 x 15 10 x 12.5	0.083 0.080	0.166 0.160	840 865	10 x 16	0.110	0.22	1050	10 x 25	0.064	0.128	1350
270	271	8 x 20	0.064	0.128	1050	10 x 20 12.5 x 16	0.078 0.079	0.156 0.158	1220 1260	12.5 x 20	0.057	0.114	1500
330	331	10 x 16	0.060	0.120	1210	10 x 25	0.072	0.144	1440				
390	391									12.5 x 25	0.043	0.086	1900
470	471	10 x 20 12.5 x 16	0.046 0.049	0.092 0.098	1400 1450	10 x 30 12.5 x 20 16 x 16	0.056 0.059 0.072	0.112 0.118 0.114	1690 1660 1690	12.5 x 30 16 x 20	0.039 0.045	0.078 0.090	2300 2000
560	561	10 x 25	0.042	0.084	1650	12.5 x 25 18 x 16	0.044 0.070	0.088 0.140	1950 1930	12.5 x 35	0.034	0.068	2500
680	681	10 x 30 12.5 x 20 16 x 16	0.031 0.035 0.042	0.062 0.070 0.084	1910 1900 1940	12.5 x 30	0.039	0.078	2310	12.5 x 40 16 x 25 18 x 20	0.029 0.035 0.042	0.058 0.070 0.084	2800 2600 2500
820	821					12.5 x 35 16 x 20	0.033 0.044	0.066 0.088	2510 2210	16 x 31.5 18 x 25	0.029 0.034	0.058 0.068	2850 2800
1000	102	12.5 x 25 18 x 16	0.027 0.043	0.054 0.086	2230 2210	12.5 x 40 16 x 25 18 x 20	0.027 0.033 0.047	0.054 0.066 0.094	2920 2555 2490	16 x 35.5	0.027	0.054	2900
1200	122	12.5 x 30 16 x 20	0.024 0.027	0.048 0.054	2650 2530	16 x 31.5 18 x 25	0.027 0.028	0.054 0.056	3010 2740	16 x 40 18 x 31.5	0.025 0.028	0.050 0.056	3400 3300
1500	152	12.5 x 35	0.020	0.040	2880	16 x 35.5	0.024	0.048	3150	18 x 35.5	0.025	0.050	3400
1800	182	12.5 x 40 16 x 25 18 x 20	0.017 0.021 0.026	0.034 0.042 0.052	3350 2930 2860	16 x 40 18 x 31.5	0.021 0.024	0.042 0.048	3710 3635	18 x 40	0.024	0.048	3500
2200	222	16 x 31.5 18 x 25	0.017 0.019	0.034 0.038	3450 3140	18 x 35.5	0.022	0.044	3680				
2700	272	16 x 35.5 18 x 31.5	0.015 0.015	0.030 0.030	3610 4170	18 x 40	0.018	0.036	3800				
3300	332	16 x 40 18 x 35.5	0.013 0.014	0.026 0.028	4080 4220								
3900	392	18 x 40	0.012	0.024	4280								

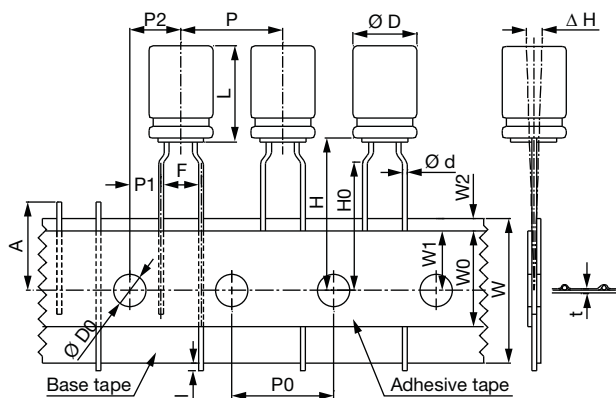


Fig. 1

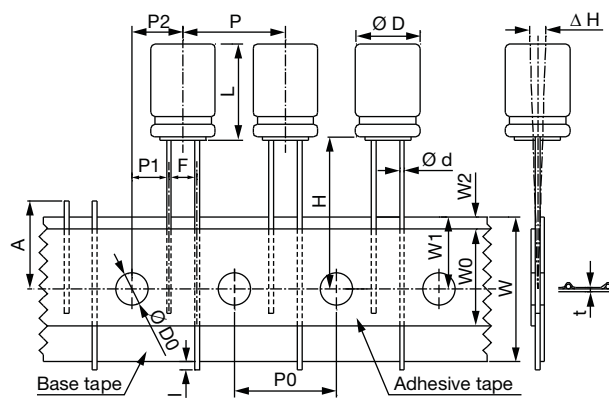


Fig. 3

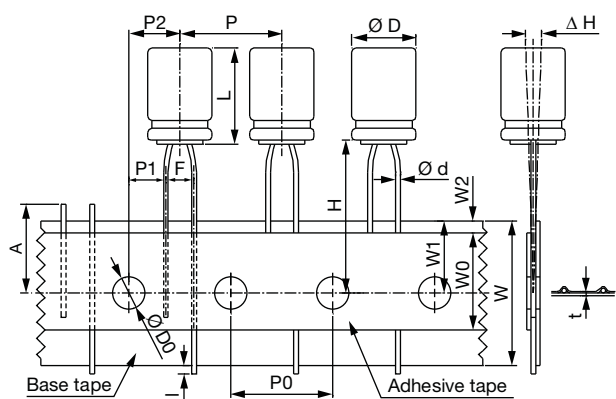


Fig. 2

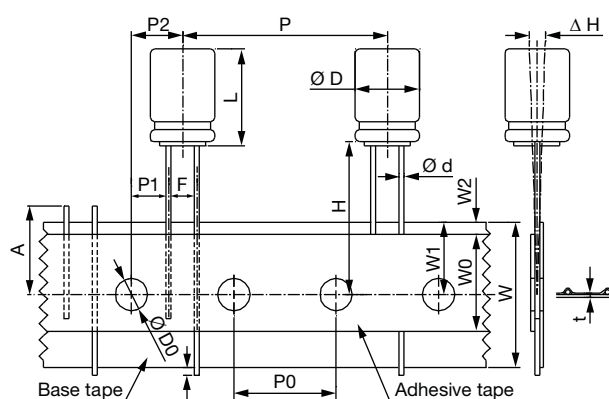


Fig. 4

TAPE SPECIFICATIONS in millimeters

PACKING	TF												TN																			
L	5					7 to 9				≥ 11			5					≥ 7	7 to 9		11.5 to 20			9 to 25								
Ø D	3	4*	5	6.3	8	5	6.3	8*	5	6.3	8	3	4*	5	6.3	8	5	6.3	8	8	TOL.		10	12.5	TOL.							
SYMBOL																																
Ø d	0.4	0.45			0.5			0.5		0.6		0.4	0.45			0.5		0.5		0.6	± 0.05		0.6		± 0.05							
F	5.0				5.0				5.0				2.5				2.5		3.5		3.5	+ 0.8/- 0.2		5.0		+ 0.8/- 0.2						
H	17.5				17.5				18.5		20.0		17.5				17.5		17.5		18.5	± 0.75		18.5		± 0.75						
H0	16.0				16.0				16.0				-				-		-		-	± 0.5		-		± 0.5						
P	12.7				12.7				12.7				12.7				12.7		12.7		12.7	± 1.0		12.7	25.4	± 1.0						
P0	12.7				12.7				12.7				12.7				12.7		12.7		12.7	± 0.2		12.7		± 0.2						
P1	3.85				3.85				3.85				5.1				5.1		4.6		4.6	± 0.5		3.85		± 0.7						
P2	6.35				6.35				6.35				6.35				6.35		6.35		6.35	± 1.0		6.35		± 1.3						
W	18.0				18.0				18.0				18.0				18.0		18.0		18.0	± 0.5		18.0		± 0.5						
W0	6.0				10.0				10.0		12		6.0				10.0		10.0		12.0	Min.		12.0		Min.						
W1	9.0				9.0				9.0				9.0				9.0		9.0		9.0	± 0.5		9.0		± 0.5						
W2	1.5				1.5				1.5				1.5				1.5		1.5		1.5	Max.		1.5		Max.						
A	11.0				11.0				11.0				11.0				11.0		11.0		11.0	Max.		11.0		Max.						
Ø D0	4.0				4.0				4.0				4.0				4.0		4.0		4.0	± 0.2		4.0		± 0.2						
ΔH	0				0				0				0				0		0		0	± 1.0		0		± 1.0						
l	1.0				1.0				1.0				1.0				1.0		1.0		1.0	Max.		1.0		Max.						
t	0.7				0.7				0.7				0.7				0.7		0.7		0.7	± 0.2		0.7		± 0.2						
Fig. No.	1												2		3		2		3		3		3				3		4			

Notes

- For Ø D = 10, H = 20.0 ± 0.5 is available, in this case, the dimensions of H is not specified
- 4 Ø in mark of “*” is 4 Ø x 7 L the same spec. “TN” packing: 5 to 6.3 Ø x 11 L in H is 18.5
- For 3 to 8 Ø x 5 L, W0 = 10.0 is available

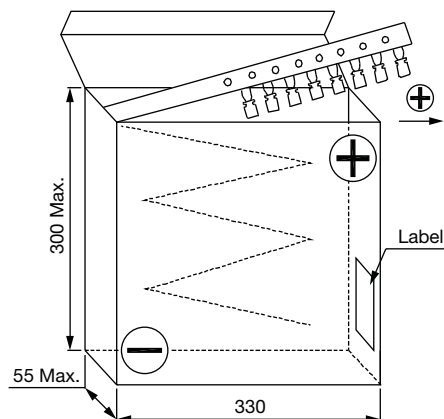
PACKAGING


Fig. 5 - Ammopack box

PACKAGING QUANTITY (pcs per box)							
Ø D (mm)	3	4	5	6.3	8	10	12.5
TF, TN	3000	2000	2000	2000	1000	500	300

Note

- The component shall be oriented on the tape as such that the positive lead is leading or the negative lead is leading with customer's request

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